BKD in ”North-European” salmonid aquaculture and wild stocks

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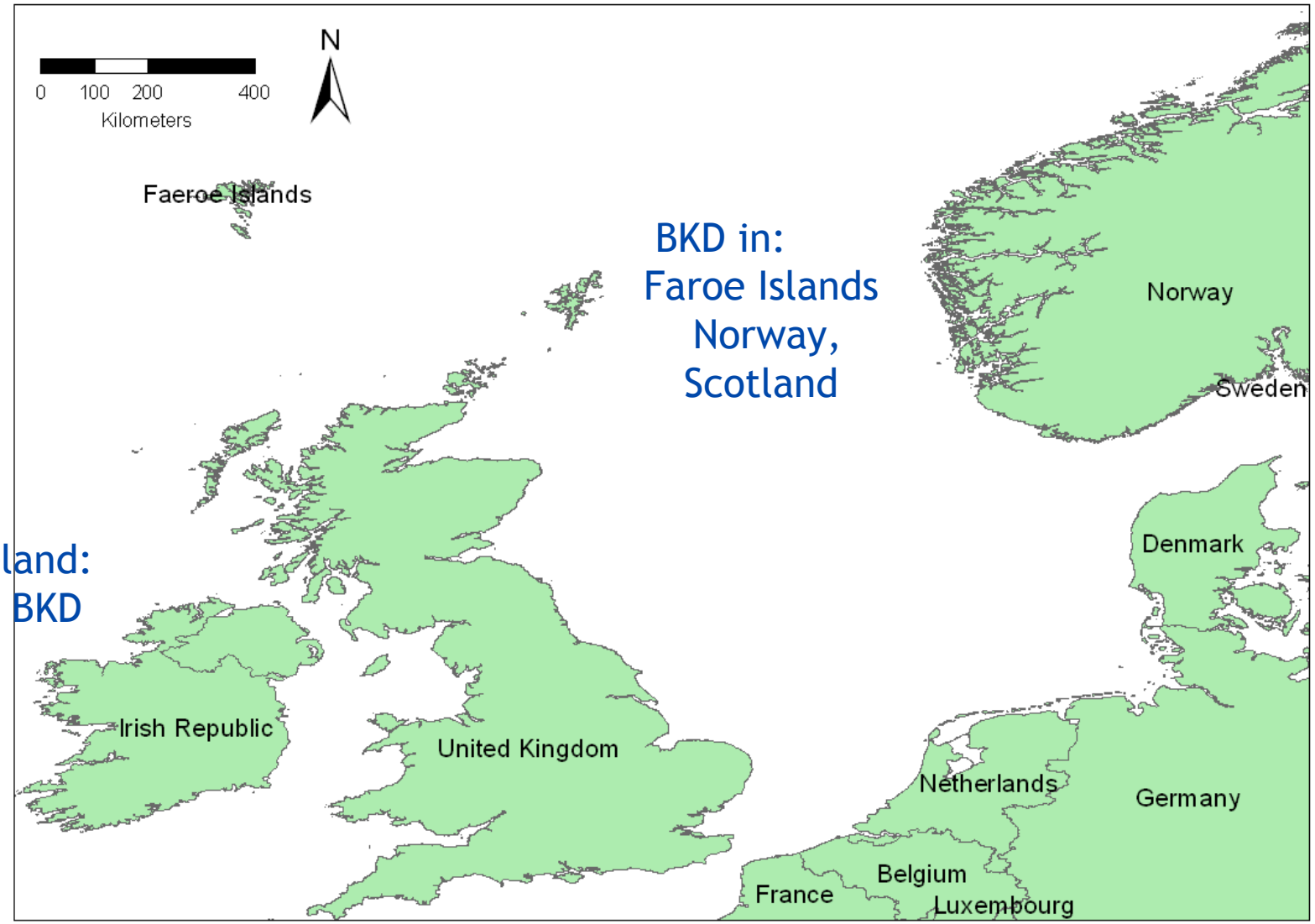
North Sea: Atl salmon farming dominates in Norway, Scotland, Faroe Islands & Ireland



“Baltic Sea” : Rainbow trout farming dominates Sweden, Finland, Denmark

BKD – the start

Country	1st case	Species	Notifiable
United Kingdom	1930 1976	Feral Atl salmon Farm R trout	1978
Norway	1980	Feral/farm Atl salmon	1968
Sweden	1985	Farm R trout	1986
Finland	1989	Farm R trout	1987
Faroe Islands	1990	Farm Atl salmon	1987
Denmark	1997	Farm R trout	
Ireland	None		1992

“Baltic sea” : Sweden

- 70 outbreaks - mainly rainbow trout farms, all over Sweden
  - 21 of these still infected and operating in 2003

- Epidemic in the fast growing rainbow trout industry 1985-1990
- Control achieved by movement restrictions and sanitation:
  - A few ”nodes” responsible for most of the spread

- Losses:
  - Rainbow trout – usually <5%, range 0-30%
  - Atl salmon, char: few cases, but high mortality – 40-50%

- Only 3 feral fish found infected despite extensive testing;
  - Feral fish is believed to be of minor importance to control

“Baltic Sea” : Finland

- First case at the island Åland in 1988
  - Rainbow trout farm – importing from Sweden
- Transfer of infected farmed R trout from Åland to coastal area
  - Year 2002; 21 of 94 farms infected
- Strategy:
  - keep continental hatchery operations free
    - ”one-way traffic” to the coast..
  - pragmatic control in the coastal on-growth farms
- Since 1988 – extensive screening of wild broodfish (1000/year):
  - One isolation of Rs in sea trout (*S truttae*) in 1990

“Baltic sea” : Denmark

- Rainbow trout farming
- 1997 first finding in very few farms
- Later discovered also in South and Middle of Jutland (Egtvedt…)
- Usually minimal disease problems – with occasional exceptions
  - been overlooked for some time??

- Strategy:
  - Industry program to keep a core of 25 BKD (and IPN) free farms as a source BKD free material
  - Restock only with certified BKD free material upstream of BKD-free farms

North Sea: Scotland

- BKD in feral Atlantic salmon, pre-farming times.
  - Not seen in the river Dee river since 1961 !
  - From 1994 wild fish surveys indicates a very low prevalence / absence of BKD
- Farm problem since 1976
- Losses variable – up to 20%
- 2003, proportion infected farms:

  Rainbow trout: 8/79 farms

  Atlantic salmon: 7/549 farms – mostly seawater

- Surveillance program in combination with IHN/VHS

Ireland – a contrast

- BKD never found :

No finding in diagnostic material since 1983

No finding in the combined BKD/IHN/VHS screening done since 1994

North Sea: Norway – a bad start

- 1980: two restocking hatcheries and three commercial farms; i.e. all with feral brood fish links, no imported material

- 1984: Klondike – and serious roe shortage:
  - Feral fish stripped indiscriminately and illegally
- BKD spreads to large parts of the industry in 4-5 years
- Non-farming areas in southeast Norway are still BKD free

- The early farmers dream:
  - FW hatchery, SW ongrowth + broodfish and slaughterhouse

all within spitting distance = a biosecurity nightmare

Norway:
Aurland feral fish hatchery 1981

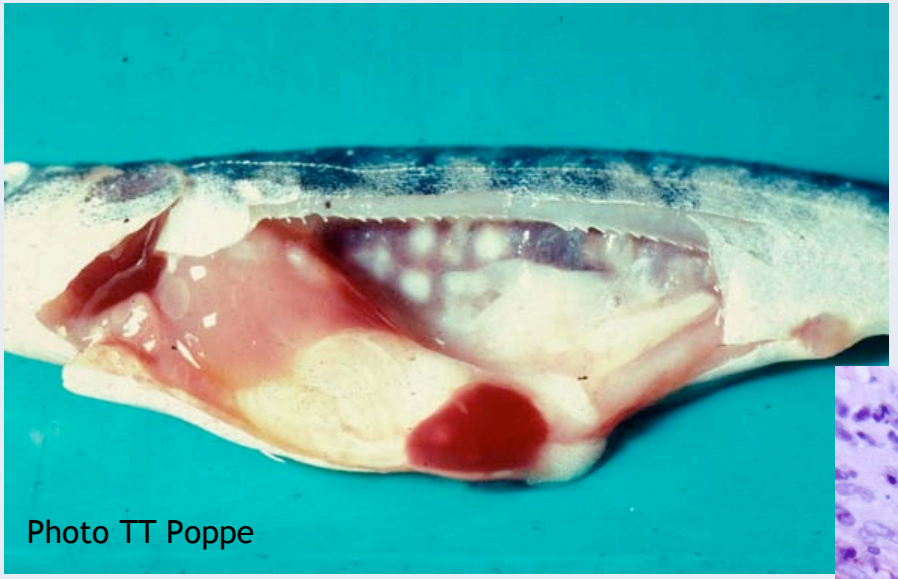


Photo TT Poppe

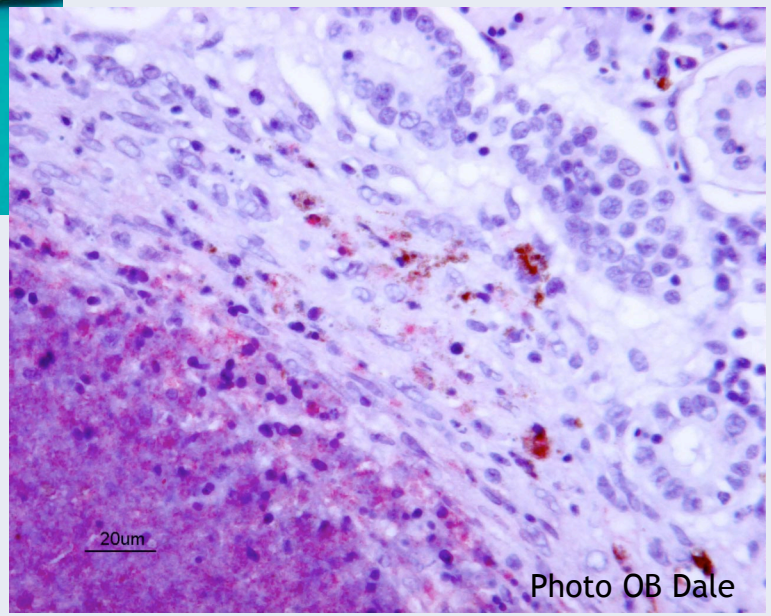
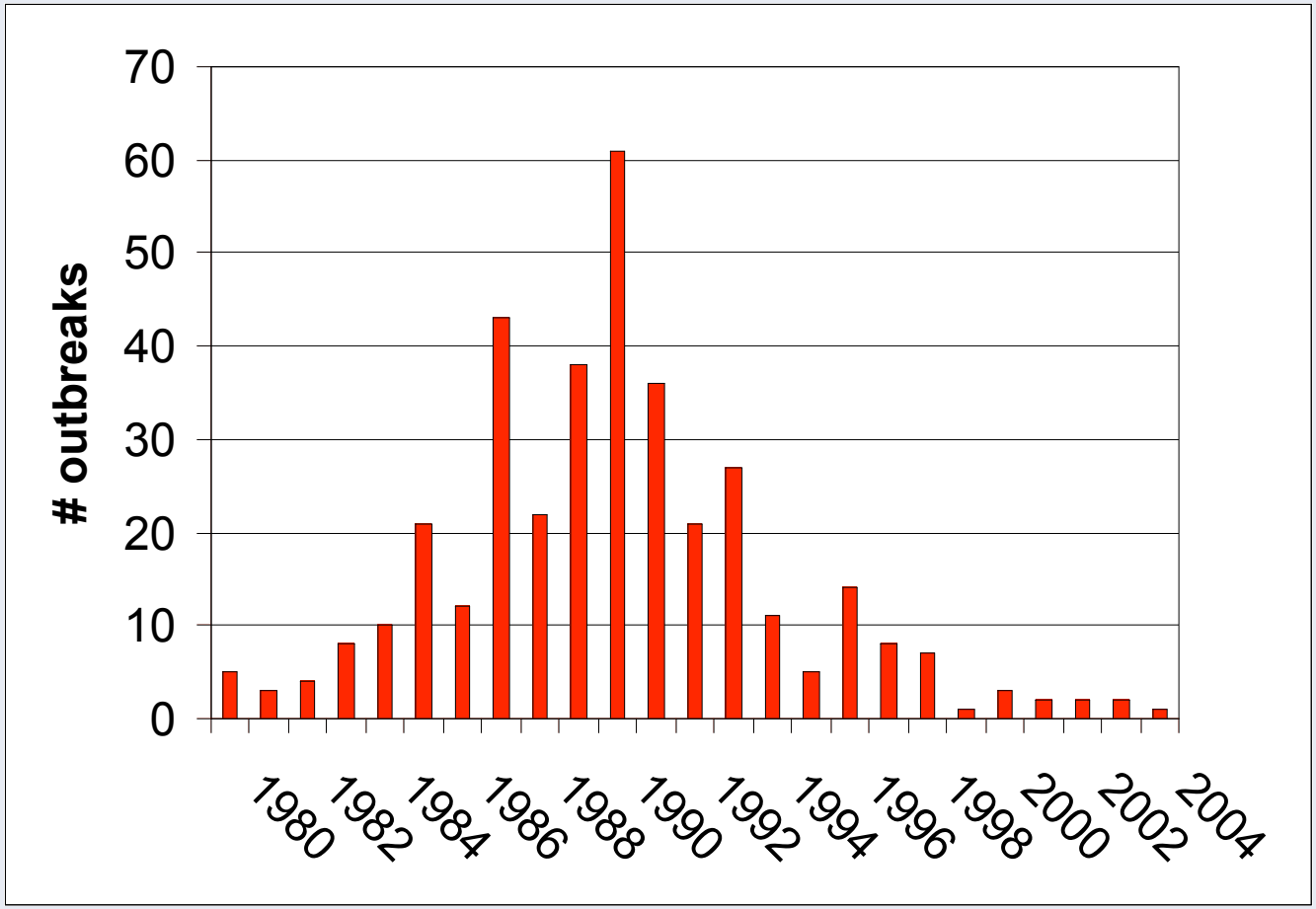


Photo OB Dale

Immunohistochemistry with Mab 4D3: Red bacteria

Norway: Disease diagnostics 1980-2004

Total number of BKD outbreaks: 367



Norway: BKD broodfish survey 1992 - 96

Category	Prop pos	% pos
Commercial	0/1041	0
Feral	6/4048	0,15

A lot of work to find 6 pos Atl salmon from 3 rivers

Feral fish species tested:	
Atlantic salmon	87 %
Brown/Sea trout	12%
Arctic Char	1%

Norway: After such a bad start - why did BKD “disappear” ?

Impact of several infectious disease, esp ISA :

general biosecurity measures in the early ’90ies

Bankruptcy led to fallowing of many farms with BKD

BKD specific sanitation measures:

Broodstock:

cull the whole stock if any BKD is found

FW hatchery/smoltproduction:

movement restrictions

SW ongrowth:

sanitary slaughter – but most often time allowed for ongrowth till market size

Norway, early 1990'ies: Biosecurity measures

- Year class separation / fallowing
- Hatchery water source free from anadromous fish, (or disinfection intake water)
- Well boat disinfection
- Brood fish health control – autopsy mandatory
- Health and origin certificate for transfer of live fish
- No movement of fish after transfer to SW
- Minimum distances between farms, biomass limits
- Movement restrictions in zones around disease outbreaks
- Slaughter hygiene regulations

Norway: Avoidance of BKD in brood stock

- The local fish health services systematically checks for BKD
  - mortalities esp in the spring checked thoroughly
  - slaughterline control of sister groups to potential broods
  - last months before stripping all diseased fish BKD-tested
- If no BKD is found before stripping, no further testing - unless suspect lesions on autopsy after stripping
- A strong motivation to find BKD early:
  - If BKD is found the last spring: still valuable slaughter fish
  - If BKD is found the last fall: a waste problem and no roe
- Brood stocks are kept in seawater – but preferably not brackish fjords with infected sea trout populations…

Control of domesticated brood fish is not what you do the day you harvest the perfect roe -

but what you have done all the other days since that fish hatched

Measures against BKD in feral fish cultivation

- Broodfish testing mandatory in endemic areas
- Intake water source free from anadroumus fish
- Ideally 1 male + 1 female mating: batches kept separate during the hatchery period
- Prevent horizontal transmission between the batches
- No recirculation of water !
- Sorting out any batches coming down with BKD
- Stocking batches without detectable disease
  - The infection status unknown – but assumed to not deteriorate the BKD situation in the river
- BKD free feral Atl salmon river strains is a valuable asset for the industry – no

North Sea: Faroe Islands

- Atlantic salmon only
- 1990; Wide spread due to infected brood fish:
  - Out of 25 fjords (70 seasites): 20 infected
  - Out of 22 freshwater farms: 10 infected
- Losses: Usually 5-25% crude mortality

- 1990-2004: Tried ”everything” – in vain

- 2005: No infected farms - fallowing due to ISA!
  - New very strict biosecurity measures

    ex: Brood fish to be kept on land

What is behind the bewildering experiences?

BKD problems seen almost exclusively in farm fish

No BKD in feral fish under natural conditions or:

- lack of diseased fish due to predators “cleaning up” ?
- prevalence of covert infections underestimated ?

- Atlantic salmon:
  - Index case in feral Atl salmon used as brood fish
  - Then spread among farms: transfer infected live fish & roe
  - Disease quite rapidly apparent – autopsy no bad “test”

- Rainbow trout:
  - Negligible, insidious disease problems makes wide spread possible before anyone discovers BKD ?

Acknowledgdements

Tore Håstein is behind all our Norwegian disease records

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Peter Østergard – Faroe Islands
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David Bruno – Scotland
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